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RESULTS OF THE SECOND ANNUAL PINE BEETLE SURVEY OF KLAMATH AND LAKE COUNTIES, OREGON EXCLUSIVE OF THE AREA WITHIN THE SOUTHERN OREGON-NORTHERN CALIFORNIA CONTROL PROJECT

(Cooperatively carried out by the Klamath Forest Protective Association, the U. S. Forest Service and the U. S. Indian Service.)

January, 1924

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SECOND ANNUAL PINE BEETLE SURVEY
OF
KLAMATH AND LAKE COUNTIES, OREGON
OCTOBER & NOVEMBER, 1923

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Foreword

This is a report of the results of the second annual pine beetle survey of that pine timber in Klamath and Lake Counties, Oregon, which is outside of the area included by the pine beetle control project now in progress in southern Oregon and northern California.

Annual systematic surveys of this kind make possible the prompt detection of dangerous beetle conditions. Quick action on incipient outbreaks discovered by such surveys may reasonably be expected to prevent the development of large destructive beetle epidemics such as the one which recently covered over a million acres of pine timber in southern Oregon and northern California and which necessitated control measures on a large scale.

The results of the first survey were covered by a report issued in January, 1923. Although situations were reported then which demanded careful watching, no area actually needing control work was discovered. However, the second survey, the results of which are discussed in this report, brought to light an epidemic in the Fort Rock district that requires prompt and careful consideration of both government and private interests.

This annual beetle survey is a part of the permanent beetle protection program which the Klamath Forest Protective Association, the U. S. Indian Service and the Forest Service propose to carry out for Klamath and Lake Counties. These agencies consider the continuation of these surveys to be just as important as the successful completion of the control operations now in progress in these two counties.

The General Situation

Klamath and Lake Counties, Oregon contain in excess of 4,500,000 acres of privately and federally owned timber. Western yellow pine (Pinus ponderosa) is by far the most important timber tree and it is estimated that the volume of this species in Klamath and Lake Counties is over 30,000,000 M. board feet.

About 1,200,000 acres of the above area containing 13,000,000 M. board feet of the yellow pine is included in what is known as the "Southern Oregon-Northern California Pine Beetle Control Project". It is

on this area that during the ten-year period 1910-1920 the western pine beetle killed at least 1,200,000 M board feet of the best timber, or almost 10 per cent of the yellow pine now living. This tremendous beetle epidemic was so destructive that in 1922 the timber owners and the Federal Government started the carrying out of a control plan, the technical phases of which had been previously carefully worked out by the U. S. Bureau of Entomology. Since 1922, the timber owners have spent in excess of $175,000 in stamping out this beetle epidemic. By July 1, 1924 it is expected that the major work on this project will have been completed. After July 1, 1924, the efforts will be confined to carefully watching the progress of the beetle attacks within the project area and putting under control all dangerous outbreaks as soon as they are found. In other words, as soon as the remedial work is finished this spring, the efforts will be directed to preventing the re-appearance of large and destructive outbreaks which not only kill much timber but are expensive to control. The control work now completed has given very encouraging results and the expense has been more than justified by the saving in timber which has already taken place.

As indicated in the previous paragraph, 1,200,000 acres of timber are included in the present control project. This leaves 3,300,000 acres of timberland in Klamath and Lake Counties outside of the control project but which are just as susceptible to beetle destruction as the timber now being given protection by the control project. The realization of this fact led to arrangements for this cooperative annual survey. By a field examination once each year, it is believed that a sufficiently close watch of beetle conditions can be kept to enable ample warning of the development of dangerous beetle conditions.

Purpose of the Survey

Briefly stated, the specific purposes of the annual survey are as follows:

1. To detect the development of any dangerous pine beetle conditions and thus make it possiole to prevent the occurrence of large destructive pine beetle outbreaks which kill much timber and are both difficult and expensive to control.

2. To ferret out from year to year the danger zones in various parts of the area which may not require control measures but which need special detailed surveys.

3. To gradually secure the basic data on which a permanent pine beetle protection plan can be based. Such data include the divisions of the area into definite beetle protection districts, the outlining of areas which always seem to be especially susceptible to beetle activity and the securing of such information as will simplify the planning of control operations when the need for such work does arise.

4. To awaken and maintain the active interest of all the timber owners to the necessity and feasibility of pine beetle protection and especially to the practical advantages of such preventive work as periodic surveys and prompt action on beetle outbreaks.

Method of the Survey

The 1923 survey followed the same general plan as that of 1922. The work consisted largely in actually seeing as much of the timber as possible by traveling through it by automobile and on foot. Infested and abandoned trees were examined from time to time and special attention was given to comparing the most recent beetle losses with those that had occurred in the previous year or two. An effort was made to roughly divide the timbered areas into five classes as follows:

1. Timbered areas containing no yellow pine and which are therefore permanently free of western pine beetle attacks.

2. Yellow pine areas which possibly because of heavy mixture of other tree species and because of elevation, seem to be relatively immune from heavy beetle damage.

3. Yellow pine areas susceptible to heavy beetle damage but at present quite free from it. These are the potential danger zones.

4. Yellow pine areas containing beetle attacks of such character and severity that very careful watching is needed even though control measures do not seem needed now. These are the active danger zones.

5. Yellow pine areas containing beetle attacks which are in immediate need of control measures.

In addition to classifying the timbered area by the above plan, estimates were made of the volumes of yellow

pine killed during 1922 on each of the 11 districts in which the survey area has been divided. These districts have exactly the same boundaries as were established in the first survey in the fall of 1922 and it is therefore possible to draw comparisons between the 1921 and 1922 losses in each of the 11 districts.

A beetle survey made in 1923 can only yield complete data on the 1922 losses. Therefore, not till the fall of this year, the time of the third annual survey, can estimates be made of the 1923 beetle damage.

About seven weeks of October and November, 1923 were spent on the survey. The Klamath Forest Protective Association furnished O. Osborne's services, automobile transportation and subsistence for nearly all of this period. Officers of the U. S. Indian Service and the U. S. Forest Service gave much help. Special thanks are due Messrs. J. F. Kimball and O. Osborne of the Association and J. A. Howarth of the Indian Service for their personal interest and effective assistance in the survey.

Results of the Survey

Timber owners who are particularly interested in the beetle situation in any one of the eleven districts into which the survey area has been divided, will find the description of each of the districts in a later section of this report. The map at the end of this report will assist in determining what timber holdings fall into these various districts.

The outstanding findings of the 1923 survey are as follows:

1. The development of an infestation in yellow pine on 60,000 acres in the Fort Rock District which demands prompt control work on the part of the Federal Government and the private timber owners, provided this recommendation is supported by the opinion of the U. S. Bureau of Entomology.

2. The existence of beetle conditions in yellow pine immediately west and north of the Sycan River on the Klamath Indian Reservation which need careful examination on the part of the U. S. Bureau of Entomology.

3. A considerable decline in the beetle infestation in the Paisley district, a district which, with the Fort Rock district, was singled out in the 1922 survey as

requiring careful surveillance. However, the Paisley infestation still remains a potentially dangerous one.

4. The continuation of temporarily safe beetle conditions in the yellow pine on the survey area with the exception of portions of the Fort Rock and Paisley districts and part of the Klamath Indian Reservation.

5. The unabated progress of extremely severe beetle attacks in lodgepole pine in the Fort Rock, Paulina and Silver Lake districts and the northern part of the Crater National Park. These infestations will eventually greatly increase the fire hazard. Only small volumes of yellow pine in mixture with the lodgepole are being killed by the mountain pine beetle which is killing so much of the lodgepole.

6. As in 1922, evidence was again found that even light fires in yellow pine bring about concentration of beetle damage. Absolute fire protection is an important part of an adequate plan of protection against beetle losses in yellow pine.

7. In general, the pure yellow pine stands again seem more susceptible to attacks by the western pine beetle than those yellow pine stands which contain a considerable volume of other tree species.

8. Private ownerships are so closely intermingled with each other and with Government timber that any effective plan of beetle protection must include all yellow pine timber in private and Government ownership.

In the report of the 1922 beetle survey, estimates of the acreage and yellow pine volumes in each of the 11 districts were included. These same estimates are again presented in the table on page 11. There are only rough approximations but they serve to give an idea of the timber values and ownerships involved in this beetle protection plan. The boundaries of the districts to which these estimates apply are shown on the map at the end of this report.

The general ownership, acreage and volume situation for the 11 districts is as follows:

Private acreage	962,000 acres
Government acreage	2,345,000 "
Total acreage	3,307,000 "
Total yellow pine volume in board feet (Private and Government)	17,390,000 M.

Of the 2,245,000 acres in Government ownership, 900,000 acres are within the Klamath Indian Reservation. Nearly all of the remaining 1,530,000 acres of Government timber are portions of the Deschutes, Fremont, and Crater National Forests and Crater Lake National Park.

Of the 3,307,000 acres of Government and private land within the survey area, not more than 2,500,000 acres contain commercial stands of yellow pine. It is hoped that in the next survey report a map can be included which will show the location of these bodies of yellow pine.

The following table gives the ownerships, acreages and yellow pine volumes by districts:

Table 1

Acreages and Yellow Pine Volumes within Survey Area.

Name of District*	Timbered Acreages			Total Yellow Pine Volume in M. feet B.M. (Private and Federal)
	Private	Federal	Total	
Fort Rock	150,000	176,000	326,000	1,650,000
Crescent	205,000	327,000	532,000	2,650,000
Paulina	236,000	140,000	376,000	840,000
Silver Lake	102,000	114,000	216,000	1,500,000
Paisley	53,000	172,000	225,000	1,100,000
Thomas Creek	41,000	84,000	125,000	710,000
Warner	51,000	82,000	133,000	1,060,000
Pelican Bay	8,000	132,000	140,000	600,000
Fort Klamath	31,000	144,000	175,000	1,280,000
Crater Lake National Park	0	159,000	159,000	no estimate
Klamath Indian Reservation	85,000	815,000	900,000	6,000,000
Totals	962,000	2,345,000	3,307,000	17,390,000

* See map at end of report for boundaries of districts.

The 1921 and 1922 beetle loss on the survey area was as follows:

1921	40,060 M. board feet.
1922	40,620 M. board feet.

The increases in parts of the Fort Rock district and the Klamath Indian Reservation were almost offset by the decreases in the remainder of the survey area.

This beetle damage is caused almost wholly by the western pine beetle (Dendroctonus brevicomis), the same beetle which is responsible for most of the tremendous beetle loss on the southern Oregon-northern California pine beetle control project. This beetle attacks only western yellow pine (Pinus ponderosa). Ordinarily only an occasional tree, perhaps ten trees each year on a section, is killed by this insect but occasionally and at intervals which cannot be predicted in the light of our present knowledge, the beetles increase with such rapidity that within three or four years a low loss may be replaced by a loss of two or three per cent of the timber in a single year. The beetles kill trees by girdling the living tissues with their many winding galleries.

On the survey area the volume of the average tree killed by the beetles averages from 700 to 1,100 board feet. In other words, it is timber of commercial size that is most commonly attacked.

As has already been stated, the 1922 beetle loss on the survey area is approximately the same as for the year 1921 except that portions of the Fort Rock district and a small part of the Klamath Indian Reservation show distinct increases. The difference between the 1921 and the 1922 beetle losses is not sufficient to justify detailed comparisons district by district. Such a comparison can be made by a study of the data in last year's report. The following table sets out the 1922 beetle losses in yellow pine by volume, number of trees per section, and per cent of the volume killed.

Table 2

1922 Beetle losses in Yellow Pine*

Name of District.	Yellow Pine Volume Killed in 1922 M.Ft. B.M.	No. of Y.P. Trees killed per Section in 1922 in Commercial Y.P.Stands	Per cent of Volume of Y. P. Stand killed in 1921
Fort Rock	4,950	30	0.3 of 1 percent
Crescent	3,975	15	0.15 of 1 "
Paulina	1,680	20	0.2 of 1 "
Silver Lake	3,000	20	0.2 of 1 "
Paisley	3,420	35	0.3 of 1 "
Thomas Creek	1,775	25	0.25 of 1 "
Warner	2,120	20	0.2 of 1 "
Pelican Bay	1,500	25	0.25 of 1 "
Fort Klamath	3,200	25	0.25 of 1 "
Crater Lake National Park	No estimate	10	0.1 of 1 "
Klamath Indian Reservation	15,000	25	0.25 of 1 "
Totals	40,620	- -	0.23 of 1 percent

Note: At the time of this survey (October and November, 1923) only the complete 1922 loss can be estimated. The total beetle loss for 1923 can not be estimated until the next survey in the fall of 1924. The beetle-killed trees have an average volume of from 700 to 1,100 board feet per tree.

General Recommendations

The western pine beetle situation revealed by the 1923 survey justifies the following recommendations:

1. That the Forest Service and the private timber owners in the Fort Rock district come to some agreement as soon as possible for the handling of the epidemic infestation now in progress in that district.

2. That in the next detailed pine beetle survey of the southern Oregon-northern California pine beetle control project by the U. S. Bureau of Entomology that Bureau be requested to include in its survey as much of the yellow pine timber immediately west and north of the Sycan River on the Klamath Indian Reservation as seems to be suffering from beetle damage of epidemic severity. A more detailed description of this area is given in a later section of this report.

3. That the Paisley district continue to be given special attention by members of the Forest Service and the Klamath Forest Protective Association.

4. That this annual survey be continued as a cooperative project between the private owners, the U. S. Indian Service and the U. S. Forest Service because of the close intermingling of ownerships and because comparable data collected systematically and periodically are the only safe basis for decisions as to the desirability and character of control operations.

5. That emphasis continue to be placed on the importance of absolute fire protection as one of the safeguards against western pine beetle epidemics.

Findings of Survey by Districts.

In the preceding portions of this report, a general description of the status of the western pine beetle situation in yellow pine on the entire survey area was given. In many cases, private owners are interested in the conditions in only one or two districts. For their convenience, a brief summary of the beetle problem in each of the eleven districts is given. The boundaries of these districts are shown by the heavy blue lines on the attached map. The Oregon portion of the area included by the southern Oregon-northern California pine beetle control project is shown by the hatched line in the lower half of the map.

In describing the beetle infestations in the various districts, several terms are used that may need explanation. Infestations can be classed as being either normal or epidemic. Normal infestations are those which are at such

a low ebb that they result in a loss of not more than perhaps 10 to 15 trees per section per year. Usually most of this loss is in decadent and overmature timber. They are common everywhere and in present insect control practice, control measures are not directed against them. These so-called normal infestations fluctuate in severity to only a limited degree. Occasionally the normal infestations are replaced gradually or quickly by infestations of much greater but varying severity. Such infestations are called epidemic infestations and they may become a very real menace to thrifty timber. Control measures may be found necessary to combat them. At such times, as many as 300 or 400 trees may be killed in one year on individual sections by the western pine beetle. There is no sharp dividing line between normal and epidemic infestations. Epidemic infestations may be either in an increasing or a decreasing status, or for a brief time the losses caused by them may not fluctuate very much and in this case they are called balanced epidemics. In the descriptions of the insect conditions in each of the eleven districts, the infestations will be described as being normal or epidemic. The epidemic infestations will be stated as being increasing, decreasing or balanced.

The acreages given include the entire timbered acreages within the various districts. In several districts the yellow pine acreage is considerably less than half of the total acreages of the district.

Fort Rock District

1. Acreage

Private	150,000 acres
Deschutes National Forest	176,000 acres
Total	326,000 acres

2. Yellow Pine Volume 1,650,000 M. board ft.

The 1922 pine beetle loss on the entire district is estimated at 4,950 M. board feet or three-tenths of one per cent of the yellow pine volume. This represents an increase of fifty per cent over the 1921 pine beetle loss. The beetle loss ordinarily varies from 15 to 70 trees per section but certain individual sections show a 1922 loss amounting to 150 trees. Exclusive of the special area discussed in the next paragraph, the infestation is what might be designated as a low epidemic in an increasing status.

The 1922 survey revealed a heavily increasing epidemic on about 61,000 acres of private and Government timber in the southern part of the Fort Rock district. This infestation warrants cooperative action on the part of the private owners and the U.S. Forest Service. The timber resources within this proposed control project include 440,000 M. board feet of yellow pine of good quality. In 1922, the infestation killed 56,000 board feet or 80 trees per section and there is a probability of greater losses unless control measures are undertaken. The detailed information on this situation can be secured by interested owners from the Klamath Forest Protective Association.

During the past ten years there have been many forest fires in both private and Government timber in this district. It is on these old burns that the heaviest beetle losses are now concentrated.

Extremely severe infestations by the mountain pine beetle are killing large volumes of lodgepole pine and white-barked pine in the northern end of the district. Only a negligible amount of the yellow pine in mixture with the lodgepole has been killed by the mountain pine beetle.

The beetle situation in the yellow pine timber outside of the 61,000 acres recommended for consideration as a control project, is worthy of the most careful attention since the losses are apparently somewhat on the increase but no control work is needed.

Crescent District

1. Acreage

Private	205,000 acres
Government (largely Deschutes National Forest)	327,000 acres
Total	532,000 acres

2. Yellow pine volume 2,650,000 M. board feet.

The 1922 pine beetle loss in this district is estimated at 3,975 M. or fifteen one-hundredths of one per cent of the stand. In 1922 from 10 to 40 trees per section were killed. The average loss was 15 trees per section. The infestation is classed as normal and at present is not a menace to the yellow pine timber. The status of the 1922 beetle activity is practically the same as it was in 1921. The small centers of attack found in 1922 had, for the most part, become inactive in 1923.

Less than one-third of this district is covered by yellow pine stands. The remainder of the district consists mostly of white fir, mountain hemlock and lodgepole forests. Several bodies of lodgepole are suffering severely from attacks by the mountain pine beetle. These infestations will be bad fire traps within the next four or five years because of the large quantities of standing and wind-thrown insect-killed lodgepole.

Paulina District

1. Acreage

Private	236,000 acres
Government	140,000 acres
Total	376,000 acres

2. Yellow pine volume 840,000 M. board feet.

Not more than a third of the area of this district is covered by yellow pine forests. The Paulina district probably contains more lodgepole than any of the other districts in the survey area.

The 1922 beetle loss in yellow pine is estimated at 1,680 M. board feet or two-tenths of one per cent of the stand. In 1922 from 10 to 30 trees per section were killed. The average 1922 loss was 20 trees per section. The infestation is classified as normal and in its present status is not a menace to the yellow pine timber.

In 1914 and 1915, the yellow pine in the southeastern part of the district, especially in the vicinity of Embody's mill, was the scene of a heavy infestation. This epidemic activity of the beetle has been replaced to a very large extent by an infestation of low intensity and in a quiescent status.

Destructive attacks by the mountain pine beetle in large bodies of lodgepole are still in progress. So far but little yellow pine has been killed by the mountain pine beetle and present indications are that the yellow pine immunity will continue as long as most of this beetle activity is confined to the pure stands of lodgepole and does not make much headway in the mixed lodgepole-yellow pine stands.

The 1922 beetle activity is practically the same as that of 1921 described in last year's report.

Silver Lake District

1. Acreage.

Private	102,000 acres
Fremont National Forest	114,000 acres
Total	216,000 acres

2. Yellow pine volume 1,500,000 M. board feet.

The 1922 beetle loss in yellow pine is estimated at 3,000 M. board feet or two-tenths of one per cent of the yellow pine volume. In 1922 from 10 to 45 trees per section were killed. The average loss was 20 trees per section. The infestation is considered to be a high normal one. The 1922 beetle losses represent a decrease over the 1921 beetle losses which were estimated in the previous report at 3,750 M. board feet and an average of 25 trees per section.

This district contains bodies of yellow pine of high quality. The beetle attacks are largely in the nature of scattered individual trees and at present there is evidence that further declines in the beetles activity may be expected. The heaviest infestation is still on the eastern slopes of the so-called Winter Rim but the beetle activity here is quite local and largely in yellow pine of low quality.

Paisley District

1. Acreage

Private	53,000 acres
Fremont National Forest	172,000 acres
Total	225,000 acres

2. Yellow pine volume 1,100,000 M. board feet.

The 1922 beetle loss in yellow pine is estimated at 3,420 M. board feet or three-tenths of one per cent compared with the 1921 beetle loss of 4,400 M. and four-tenths of one per cent. The 1922 beetle loss varies ordinarily from 15 to 50 trees per section with an average of 35 trees per section. The 1921 average was 45 trees per section.

With the exception of the Fort Rock district, the western pine beetle infestation in the Paisley district is still the heaviest in the entire survey area. The district contains the Chewaucan Basin, a body of yellow pine timber of fairly high quality which has suffered more from beetle attacks than the other parts of the Paisley district.

Previous to 1921, most of the trees were killed in groups. The 1921 beetle losses were largely in the nature of scattered individual trees. The 1922 beetle losses were in scattered trees to a greater extent than in 1921. This may mean that still further declines in beetle activity are now in progress. At any rate, the beetle attacks are still severe enough to justify careful watching. The infestation can be classified as a declining epidemic.

The western portions of this district contain much lodgepole but this species is not suffering from the mountain pine beetle to the same extent as the lodgepole in the Fort Rock, Crescent, Paulina, and Silver Lake districts.

Thomas Creek District

1. Acreage

Private	41,000 acres
Fremont National Forest	84,000 acres
Total	125,000 acres

2. Yellow pine volume 710,000 M. board feet.

The 1923 survey showed that apparently the 1922 beetle activity in the Thomas Creek district was the same as it was in 1921. The beetle losses remained about the same. In 1922, these losses in yellow pine amounted to 1,775 M. board feet or one-fourth of one per cent of the yellow pine stand. From 10 to 35 trees per section were killed in 1922 with an average loss of 25 trees per section. The beetle activity is at a high normal stage and at the present time is not a menace to the timber.

A large part of the timber in this district is decidedly over-mature and this may account for the relatively high average loss per section which has been maintained for a number of years in the past. Many of the trees which are attacked are stag-headed decadent trees of apparently low resistance. Except for the beetle attacks in this class of timber, the beetle activity in the Thomas Creek district is at present relatively inactive. There is much evidence of the existence of a destructive epidemic infestation in yellow pine a number of years ago. The heaviest infestation now in progress is in the general vicinity of Thomas Creek Ranger Station.

Warner District

1. Acreage

Private	51,000 acres
Fremont National Forest	82,000 acres
Total	133,000 acres

2. Yellow pine volume 1,060,000 M. board feet.

The 1922 beetle loss is estimated to be approximately the same as the 1921 beetle loss given in the previous report. The 1922 beetle loss in yellow pine was 2,120 M. board feet or two-tenths of one per cent of the stand. In 1922, from 10 to 30 trees per section were killed. The average loss was 20 trees per section. The infestation is classified as normal and is not considered a menace to the yellow pine timber.

The heaviest infestation continues to be confined to the rocky southern slopes where the timber is short and occurs in very open stands. Much of the better quality of yellow pine is in mixture with other species and in these mixed stands, the yellow pine is especially free from western pine beetle attacks at the present time. In the pure stands of yellow pine there is evidence of severe beetle damage about ten years ago, evidence which points to the possibility of the ultimate recurrence of such an epidemic.

Pelican Bay District

1. Acreage

Private	8,000 acres
Crater National Forest	132,000 acres
Total	140,000 acres

2. Volume of yellow pine 600,000 M. board feet.

Practically all of the yellow pine is in the eastern half of this district. The remainder of the district consists largely of Douglas fir, Shasta red fir and white fir.

The 1921 beetle loss and the 1922 beetle loss in yellow pine are believed to be approximately the same. The 1922 loss is estimated at 1,500 M. board feet or one-fourth of one per cent of the stand. From 15 to 30 trees per section were killed in 1922 with an average killing of 25 trees per section. The infestation is classified as normal.

In those parts of the district where yellow pine logging is in progress, the timber adjacent to the cutting areas is fairly free from beetle damage. Parts of the district have suffered recently from cyclonic winds which uprooted millions of feet of green timber. In the vicinity of these windfalls, there is somewhat more infestation than elsewhere. At present, the infestations in this district are not a menace to the timber.

Fort Klamath District

1. Acreage
   Private 31,000 acres
   Crater National Forest 144,000 acres
   Total 175,000 acres
2. Yellow Pine Volume 1,280,000 M. board feet

The 1922 pine beetle loss is estimated at 3,200 M. board feet or one-fourth of one per cent of the yellow pine stand. In 1922 from 10 to 50 trees per section were killed with an average loss of 25 trees per section. In 1921, the beetle loss averaged 20 trees per section. In other words, the 1922 beetle loss represents an increase of 25 per cent over the 1921 damage. This may be called a high normal infestation.

Heavy windfalls have recently occurred in portions of this district and it is in the vicinity of these windfalls that the heaviest beetle damage is now concentrated. The situation in the district is not an alarming one but further increases in beetle activity in the vicinity of the wind-thrown timber will make a more detailed field examination by the U. S. Bureau of Entomology a very desirable thing.

Recent fires of considerable extent in this district have apparently not resulted in any great concentration of beetle activity. It is recommended, however, that the burned areas be again given special observation at the time of the next annual survey.

The occasional practice in this district of leaving saw logs in the woods for a period which is long enough to permit both the breeding and emergence of the western pine beetle is an undesirable one. Logs cut during the period beginning April 1 and ending September 1, should not be permitted to remain in the woods more than four weeks. Logs cut after September 1 may be safely left in the woods all winter but they should be hauled out not later than May 1.

The adoption of this practice will remove all possible danger of attack of living timber by beetles emerging from infested logs.

Crater Lake National Park

The National Park has a total area of 159,000 acres. Nearly all of this area is timbered.

The 1922 pine beetle loss is estimated to be not more than one-tenth of one per cent of the yellow pine stand. Not only are the yellow pine losses now at a low ebb but there is but little evidence of any recent epidemic of the western pine beetle. Much of the yellow pine in the Park, and there is not a large quantity of it, is in mixture with other tree species. Only on limited areas in the Park is yellow pine the predominant species. As is also evident in other districts in the survey area, the yellow pine in the mixed stands is suffering far less from pine beetle depredations than the yellow pine in the pure or nearly pure bodies. The yellow pine infestation in the Crater National Park is decidedly at a low normal stage.

In the northern part of the Crater Lake National Park, there are large stands of lodgepole. For several years, the mountain pine beetle has been killing many thousands of lodgepole in this part of the Park. These depredations extend northward into the Umpqua National Forest in the general vicinity of Diamond Lake. At present, the most important aspect of these infestations is that they are seriously affecting the scenic and recreational values of the region. In fact, this phase of the problem is of sufficient importance to have already caused officials of the National Park Service and the Forest Service to consider the feasibility of control measures. In a few years the areas of killed lodgepole will become a real fire menace.

The Klamath Indian Reservation

That portion of the Klamath Indian Reservation south of the Sprague River and that part of the Reservation north of the Sprague River which is east of the Sycan River are included in the southern Oregon-northern California pine beetle control project. This amounts to 253,000 acres and much of this acreage has already been covered by pine beetle control operations.

Almost 900,000 acres within the boundaries of the Klamath Indian Reservation are north of the Sprague River and west of the Sycan River. This vast acreage is outside of the present boundaries of the pine beetle control project and is believed to contain at least six billion feet of yellow pine of good quality. Approximately 85,000 acres of this total are included in what is known as the Long-Bell tract. The remaining 815,000 acres consist of individual and tribal allotments of the Klamath Indians.

Since 1919, caterpillars of the Colorado Pandora Moth have defoliated more or less seriously at least 200,000 acres of the yellow pine There is evidence now that this tremendous defoliation is rapidly on the decline. Many thousands of yellow pine trees have suffered the loss of nearly all of their needles while a greater number lost part of their foliage. So far, these weakened trees have not been attacked by the western pine beetle to any greater degree than those which have not been defoliated by the caterpillars. However, the trees are probably weakened sufficiently to lower their resistance against any fires which may occur.

Within the past ten years, there have been several large fires on the Reservation. In some of the more recent burned areas, there is evidence of increased beetle activity of a temporary character but no epidemic infestation was found to be still active on these burns.

The pine beetle infestation in the yellow pine on the Long-Bell tract continues to remain in a more or less quiescent and normal status. The 1922 losses probably do not average more than 20 trees per section, the same loss which was reported for 1921.

The western pine beetle damage for 1922 on the remainder of the Klamath Indian Reservation, that is to say the 815,000 acres outside of the Long-Bell tract and outside of the pine beetle control project, is estimated to be the same as for 1921. This loss is probably not more than 15,000 M. board feet or one-fourth of one per cent of the yellow pine stand. However, there is by no means a uniform distribution of this loss over the Reservation. In the western and northern portions of the Reservation the yellow pine losses seem somewhat less than they were in 1921 while the yellow pine stands immediately west and north of the Sycan River are suffering to an extent that warrants their inclusion in the detailed survey of the southern Oregon-northern California pine beetle control project which is to be made this summer by the Bureau of Entomology.

The area recommended for this careful survey is included by a line drawn between Saddle Mountain and Calimus

Butte, a line drawn between Calimus Butte and Taylor Butte. a line drawn in an easterly direction between Taylor Butte and the Sycan River and finally, by a line following this point on the Sycan River to the Sprague River. This is an area of about 100,000 acres of which slightly more than one-half consists of pure or nearly pure yellow pine forests. The remaining half is made up of mixed stands, lodgepole forests and grassland. There are parts of this area in which the 1922 beetle loss in yellow pine unquestionably amounts to as much as 100 trees per section. It is believed that this area includes the heaviest western pine beetle infestation on the Reservation not now included by the southern Oregon-northern California pine beetle control project.

Legend Sheet to Accompany Map

The hatched line represents the boundaries of the Oregon portion of the southern Oregon-northern California pine beetle control project.

The heavy blue lines are the boundaries of the eleven districts included in the Klamath and Lake Counties survey described in this report.

These eleven districts are as follows:-

Fort Rock

Crescent

Paulina

Silver Lake

Paisley

Thomas Creek

Warner

Pelican Bay

Fort Klamath

Crater National Park

Klamath Indian Reservation